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"GLEANINGS FROM OUTCROPS OF SILURIAN
STRATA IN THE RED RIVER VALLEY."

—BY—

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Ag. College Joseph

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GLEANINGS FROM OUTCROPS

Of Silurian Strata in the Red River Valley, Manitoba.

Early in the autumn of 1883 I made my first visit to Selkirk for the purpose of examining rocks exposed in that vicinity. To my surprise I found the remains of primeval life exceedingly numerous in the rock that was being quarried. Struck with the profuseness of fossils, I at once concluded that the Silurian strata of the Red River Valley would afford prolific results if made an object of research.

My occupation during the summer of 1883 was such that I was unable to make but a few visits to neighboring exposures. But the present year (1884) brought more leisure for scientific research, better opportunities and greater facilities for a thorough examination of these strata. Besides, a personal examination of the various outcrops described in this paper, on which occasions I have had excellent opportunities to examine the rocks *in situ*, there has also been examined a very large quantity of stone brought to Winnipeg from the quarries and used both for ordinary building purposes and as stone to be "dressed" for ornamental work. The "dressing" of these stones has opened up a treasure-house of fossil wealth. Many of them in the rough are very large, and require to be split up into smaller pieces before being dressed. As these have been opened, some most interesting specimens of primeval life have been revealed. Nearly every day during the present summer the buildings in course of erection have been visited, and scarcely has a single visit been made without some information gained regarding the Silurian fossils of these rocks.

In placing the results of my investigations before you, I purpose describing groups of outcrops that are somewhat uniform in their lithological and palæontological characters, and enumerate the fossils found in them. After which to give some conclusions arrived at from the consideration of the whole. The accompanying sketch map represents the location of the seven outcrops described in this paper.

(A sketch map showing the position of the exposures was on exhibition.)

EXPOSURE 1.

This quarry, situated on the east side of the Red River about 21 miles northeast of Winnipeg, is but a short distance from Selkirk station, on the Canadian Pacific Railway, and about one-half mile from the river. The exposure is not very extensive as yet, the quarry being opened but a comparatively short time. As you approach this place from the station you perceive that there is a slight elevation, well defined in the vicinity of the outcrop. Looking at the face of the rock you observe that the strata are covered with

about four feet of loose drift in the southern part, but full ten in the northern. In this are numerous boulders, a few gneissoid, but most of them the same material as the solid rock, and of a more or less angular nature. The strata on the east side is quite horizontal, but on the west very much tilted. There appears to be a break through the centre of the quarry, indicating a marked upheaval at one time. This likely took place after the glacial period, for the glacial drift is deposited quite irregularly over the disturbed rock.

On the west side there are immense fragments lying at an angle of 45° with vacant spaces like caves below them. From the raised appearance of this part it seems as if the apparent mound over the quarry has had its origin in this upheaval.

Fossils appear after the first layer of rock is removed. No part of the quarry as yet seems more prolific than another. The layers of rock are about 2 feet thick, and exposed to a depth of 12 feet. Neither from personal observation nor from questioning the workmen have I been able to ascertain that certain fossils characterise particular beds. The most casual observer could not fail to observe the fossils on the stones of this place. Remains of Cephalopods Corals and the genus Receptaculites are seen on every side, the last being exceedingly common. The Cephalopods are numerous and large—several 5 to 7 inches in diameter have been observed.

The rock from this place is largely used in Winnipeg for ornamental stone. Being comparatively soft it "dresses" readily and takes a good finish and when burnt produces a very white lime. It is of a greyish white color and effervesces strongly on treatment with cold Hydrochloric acid. It presents a peculiar mottled-like appearance which adds much to its beauty as an ornamental stone. This strange mixture of brown and white is difficult to account for. In some cases it appears as if its origin might be due to seaweed remains. Often the colored portion approaches the color of yellow ochre and seems strongly impregnated with iron, while the intervening spaces are more or less colored. So marked is this mottled condition that the stone from Selkirk district can be distinguished at once from the rock described in a subsequent part of this paper. Of the various exposures visited this has afforded the best results, and as already remarked the fossils cannot be connected with particular beds but are found within a thickness of 10 feet. In several of the thick fragments of rock though no lines of stratification can be seen, still in many cases they readily split. When this is done peculiar markings are frequently observed. These appear to be the remains of plant-life. Portions of stems can be made out, but the whole are in a confused condition and no definite characters are discernible. Notwithstanding fossils are numerous in this limestone and in many cases their generic characters easily observed yet we often find the specific comparatively obscure and difficult to identify.

EXPOSURE 2.

This quarry is about half a mile northwest of No. 1, and situated nearer the town of East Selkirk on the west side of the Railway track. Here the rock is not so near the surface as in the preceding, but covered with about 20 feet of *drift* material which renders it more difficult to quarry the stone. The *drift* is full of large boulders of the same material as the solid rock below.

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These are taken out and shipped to the city. Only a few feet of the solid rock has been worked, and though many fragments are lying about, yet they do not appear as prolific in fossils as at the rock at the former quarry.

The stone is the same as already described in general appearance, but is said to be slightly softer and preferred by stone-dressers.

EXPOSURE 3.

This outcrop is situated on the west bank of the Red River a short distance south of what is known as the "Stone Fort," and about $4\frac{1}{2}$ miles southwest of the places already referred to. Here the rock is on the bank of the river 5 feet above the water level. About 15 feet of *drift* overlies the stone. This rock while to a great extent it resembles in external characters that from exposures 1 and 2 seems to be harder, but breaks very readily, and in some cases presents a conchoidal fracture.

A large quantity of this stone was quarried during the past winter and conveyed to Selkirk to be used in the erection of the provincial asylum. I had an excellent opportunity of examining this stone on the asylum grounds, where large quantities of it was lying. Whether the fact of its being quarried in winter affected its condition I am not prepared to say, but it certainly possessed some characters differing much from the rock at East Selkirk. The stone-cutters pronounced it a very fine rock to work and much superior to any of the Red River stone they had dressed.

Very little could be seen at the quarry. The surface had fallen into the excavation during the spring and covered up the rock, but during several examinations at the public buildings some very fine specimens were obtained. Fossils were very common and peculiar in as much as they were in some cases like those found at Stony Mountain in an entirely different kind of rock, thus forming a sort of transition between the rocks at Selkirk East, 4 miles further down the river, and those of the mountain situated several miles west of it. This is an important point and well worthy the attention of future investigators.

Orthis testudinaria, chætetes lycoperdon and one imperfect specimen of the genus Rhynchonella, common fossils at Stony Mountain, were found at this place.

Several masses of a coral apparently of the genus Diphyllum were found here only. Crinoid stems and some fragments of Polyzoa were also observed.

I was very much surprised at the results obtained from this outcrop, for I had found none of the above mentioned at either of the East Selkirk exposures, and am inclined to consider this a connecting stratum between those of Stony Mountain and East Selkirk.

Mr. McCharles, of Winnipeg, has found specimens of the genus Spirifera here, but as the stone containing them was a rounded fragment it may have come from elsewhere, probably the Deronian rocks, supposed to lie west and north of this part.

EXPOSURE 4.

This is still farther south, being about four miles up the river. In this vicinity numerous limestone boulders are found.

These are much the same in character as the rocks of the preceding quarries. They are frequently collected by farmers in the neighborhood and used in making lime.

At places near the water's edge the rock appears, and fragments which have been scattered along the river, and more or less waterworn, often show very well defined fossils, especially of the genus *Orthoceras*, much "weathered" and very distinct.

No large exposure occurs in any part like those of outcrops 1, 2, 3, as no stone is quarried at present in this district, but it is evident from the innumerable limestone boulders scattered along the river that rocks *in situ* are not far below the surface. These exposures show that this band of mottled whitish grey rocks extends at least in width for a distance of 8 miles, and that this rock is very uniform in its external character.

The following is a list of fossils obtained from the outcrops referred to as Exposures 1, 2, 3, 4. Although I have had access to Hall's admirable works on Silurian fossils, and reports published by the Canadian Geological Survey, I am at a loss to identify many of the specimens found in the rocks of these outcrops near Winnipeg.

PLANTÆ.

1. *Palæophycus*.—Though not well defined in specific characters, it can be readily recognized as plant remains.

PROTOZOA.

2. *Receptaculites*.—This genus is one of the most common fossils at these exposures. They vary from 5 to 10 inches in diameter. There is scarcely a large stone but shows several specimens. In every case the specific characters are very obscure. Although I have seen innumerable specimens none as yet have been observed that gave the least indication "of a great central cavity," as stated by Billings in his description of this genus. Every one is circular, none less than 5 inches in diameter and usually about 7-9 lines thick. The external and internal integuments are distinct and the peculiar tubular skeleton very marked. The rhomboidal plates are readily perceived and the rounded protuberance on the lower side easily seen.

It is difficult to get complete specimens out of the rock, as they almost invariably break up owing, no doubt, to their discoidal form and comparative thinness.

The species common here is likely *Receptaculites Oweni*, (Hall.)

3. *Stromatopora rugosa* (Hall).—A specimen some 5 inches in diameter seems to be of this species.
4. *Stromatopora*.—An entirely different form from the preceding also occurs. In this the laminæ numbering 4 to the line are well marked, and present a wave-like appearance. Three distinct crests are shown in one specimen. On the surface above these are several apertures, around which the laminæ present a series of concentric rings. This wave-like arrangement has been observed on several specimens, and seems to be a characteristic of the species.

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5. *Stromatopora*.—Another form which in some respects agrees with the description of *S. mammillata*, by Nicholson. On the surface are conical elevations, and the whole covered with stellate markings.

COELENTERATA.

6. *Columnaria alveolata* (Hall).—Very common and in large masses.
 7. *Halysites catenulatus* (Linnæus).—Also common. Some specimens very large, over a foot in diameter. A variety of this species with small corallites has been found.
 8. *Columnopora cribriformis* (Nicholson).—Quite common. The lace-like structure of the corallites and stellate appearance on the surface make it one of the most beautiful corals found in the Selkirk limestone.
 9-11. *Zaphrentis*.—Common in three forms. Each likely represents a different species. One shows a distinctly quadrilateral outline in a transverse section. Another exhibits a short but expanded cup, while the third is much longer and tapers more gradually to a point.
 12. *Heliolites pyriformis* (Hall).—Bears a marked resemblance to one species found at East Selkirk.
 13. *Tetradium fibratum* (Stafford).—Very well marked.
 14. *Chaetetes lycoperdon* (Hall).—Found only at exposure 3.
 15. *Diphyllum*.—Also restricted to the same place. Large masses found.
 16, 17. Besides these, two other species of coral seem to be present or allied to *Favosites*, the other to *Syringopora*. This gives us at least 12 species of coral from the Selkirk rocks, and there is no doubt others will be obtained on further investigation.

ANNULOIDA.

18. The only representatives of this subkingdom are fragments of Crinoidal stems, which resemble those of *Schizocrinus nodosus* (Hall.)

ANNULOSA.

Several fragments of trilobites have been obtained. These appear to be the remains of at least four species.

19. *Cheirurus*.—A well defined glabella.
 20. *Illænus*.—Several pygidia and a few body segments.
 21. *Platynotus Trentonensis* (Hall).—Several heads found resemble those of this species.
 22. *Phacops*.—The specimen obtained bears a close resemblance to the cephalic region of this genus.

MOLLUSCA.

This subkingdom is sparingly represented in numbers except among the cephalopods, which are exceedingly numerous and very large forms, some several feet in length and nearly a foot in diameter.

23. Several fragments of forms belonging to the Polyzoa.
 24. *Strophomena alternata* (Conrad).—Several.
 25. *Leptaena sericea* (Sowerby).—Found at the "Fort."
 26. *Strophomena teunistriata* (Hall.)
 27. *Orthis testudinaria* (Hall).—Peculiar to the Lower Fort.

28. *Rhynchonella increbescens* (Hall.)—Found at the same place.
 29. *Pleurotomaria subconica* (Hall.)
 30. *Pleurotomaria umbilicata* (Hall.)
 31. *Murchisonia bellicincta* (Hall.)
 32. *Murchisonia subfusiformis* (Hall.)
 33. *Maclurea*.—Several specimens have been found by the writer. One of these is very large and well preserved. Its widest diameter is $9\frac{1}{2}$ inches. From the lowest and perfectly flat side to the summit of the convex is $2\frac{1}{2}$ inches. Of the others none exceed 5 inches at the widest point.
 34. *Orthoceras*.—This genus is represented by several species in the Selkirk limestone, some of which are very large. One found is $10\frac{1}{2}$ inches wide at the well marked body chamber, $9\frac{1}{2}$ inches in length. Thirty-six segments are in view in a space of 13 inches. At the last of these the specimen is 8 inches wide.

This seems to be complete, and differs markedly from other forms in which the segments diminish in size until the fossil tapers to a point and presents a wedge-like form. Large fragments of this genus are common.

35. *Ormoceras*.—Several beaded siphuncles, apparently of this genus have been found.
 36. *Cyrtoceras*.—This genus is represented by several fragmentary specimens which show a distinctly curved form. The largest is 8 inches along on convex side, $5\frac{1}{2}$ on the concave.

They are readily distinguished from the large forms of *Lituites* 3 and 4 feet in length.

37. *Phragmoceras Hector*, (Billings)—A specimen in the writer's possession closely resembles this. 8 segments are distinct. The siphuncle is readily seen on the concave side and the large chamber well defined. But there is no indication of the peculiarly contracted aperture of the shell. This may be a different species but it seems to resemble this more than others examined.
 38-39. *Lituites*.—Some very large specimens have been found which appear to be of this genus. Two species at least are represented. One closely allied to, if not *L. undatus*, the other *L. convolvans* of Hall. One of these specimens is 36 inches in circumference. The diameter of the shell at the body cavity is $5\frac{1}{2}$ inches. Septa distinct after a thin striated covering is taken off.

This shell-like covering is invariably found on the specimens, but often cracks off when trimming the rock. These large forms are the most imposing cephalopod fossils in the Selkirk stone. None were observed by me till this summer, when several have been discovered. It is difficult to get these out of the rock. Several times when stones have been split one of these large coiled up forms has appeared with distinct convex surface in view, lead to believe that with a little care the whole could be taken out as a cast from its bed. I have been disappointed to find that the imbedded portion is so thoroughly connected with the rock that it cannot be dislodged from the matrix without injury.

The only way to secure a good specimen when a portion of it is seen in relief is to take the fragment of rock in which it is found.

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40. *Endoceras*—Many siphuncles of this genus have been obtained, and some segments, fragments of very large forms. Several of the siphuncles are fully 2 inches in diameter, and in the segments obtained the eccentric position of these is distinctly seen. A large specimen of this genus was found in the quarry near East Selkirk. Though imperfect it was over 2 feet in length and $3\frac{1}{2}$ inches in diameter. The segments were well defined and the siphuncle was distinctly colored dark brown, while the rest of the fossil had the common color characteristic of this limestone. In some of the specimens the peculiar form of the septa resembling a series of funnels placed one within the other is quite distinct.

EXPOSURE 5.

We now pass from exposures seen on or near the banks of the Red River to some at quite a distance from it. The first I shall direct your attention to is what is known as Stony Mountain, of which the following is a sketch:

(A Sketch Map of Stony Mountain was on exhibition, showing its position and outline.)

At this place, located 13 miles north-west of Winnipeg, an excellent exposure of silurian strata occurs. The so-called mountain stands like an island of limestone raised above the surface of the surrounding prairie some 60 feet. The preceding exposures have all been more or less on the level and have come into view by removing the drift deposit and quarrying into the rock, but here we have an exposure raised high above the level and the rock distinctly seen without further work.

It is several miles in circumference and resembles in outline the shape of a horse-shoe. The west and north sides are quite steep, and along the escarpments the exposed edges of the strata are easily observed, while the east gradually slopes to the prairie level. There is every appearance of the west side having at one time been almost vertical, the work of some great denudating agent. Whether water as a wide river extending between this and Stonewall where the rock seems to be also worn away on the side nearest Stony Mountain, moved on with a strong current and eroded this side of the rock, or that it was worn away by the action of a glacier is a matter for conjecture. So peculiar is this isolated patch of strata that some have even thought it was not *in situ*, but to have been moved by some great force to its present position. The more it is examined the more likely it appears to have been the work of denudation.

At the southwest corner of the mountain the rock reaches the surface. Midway on the west side are located the extensive quarries and limekilns of Mr. McAllister.

These show a fine exposure, which supplies an excellent condition for examination. The rock face is several hundred yards in length, and in some places over 16 feet in depth. Layers of jointing and stratification render it comparatively easy to quarry. As the face is cut down and removed, the drift, here about 4 to 6 feet, is thrown into the quarry, and new rock worked out, so that there is seldom more than 16 feet of rock, chiefly in layers about 3 feet thick, in view. A few boulders appear in the drift, principally gneissoid. The rock surface after the drift is removed shows excellent traces of glacial *striae*

running in a N. NW. direction. There is a slight dip of the strata to the southeast. The lime from this stone, though not so white as that obtained from the Selkirk, has the reputation of being much stronger and better suited for building purposes.

The rock is very hard and flinty, and is not affected by cold Hydrochloric acid, but on heating violent effervescence takes place. Two distinct kinds of rock are observed at the escarpment on the southwest side: one the hard dolomitic limestone of brownish-grey color, about 40 feet thick; the other a reddish-grey limestone with clayey partings, about 10 feet thick. This layer effervesces with cold acid. It is very fossiliferous, and contains a great many brachiopod shells. The upper and hard rock contains very few fossils. Those found are chiefly coral and very obscure, and usually present a somewhat rusty appearance. The small rusty-like cavities seen in this layer almost invariably contain the obscure remains of coral which seems allied to the genus *Favosites*. In some parts of this upper layer the rocks have quite a rusty appearance, but in others the stone is a light clay color, and of a hard compact nature.

The stone from these quarries above the reddish layer is used in large quantities for building, but owing to its hardness it cannot be "dressed" as readily as that from Selkirk. Consequently the city obtains most of the ornamental stone from Selkirk, and the building from Stony Mountain.

The following is a vertical section of the rock as observed during the digging of a well at the southwest part, upon which the Provincial Penitentiary is located:—

1. 20 feet solid hard stone like that at the quarries.
2. 4 " thin layers of the same.
3. 2 " solid rock.
4. 6 " thin and broken.
5. 8 " yellowish rock quite ochreous.
6. 10 " reddish layer full of fossil shells.
7. 60 " a mixture of yellow and red containing some flinty material. Quite close to the west side of the escarpment some 300 yards from the penitentiary another excavation was made and the red rock was again found to occupy a position about 40 feet below the surface. It is from the debris thrown out of this that the writer obtained his specimens.

Fossils are very readily found at this place. The weather acts upon the soft stone and separates them out in a very fine state of preservation. This results from the fossils being composed of much harder material than the deposits in which they are enclosed. Small fragments of stone only a few inches in length will sometimes be found with six or seven very complete forms of different species.

These are chiefly shells in striking contrast with the corals and Cephalopods of Selkirk rock.

Following along the escarpment on the west side you can trace this reddish deposit quite easily. The action of the weather reddens it and when pulverized as it is in some places where the path touches, it is very like red ochre, and the small shells found in this dust are also red. Some of the hard rock has a most peculiar appearance, filled with cavities which present conditions as if derived from heat. But by far the greater part of this stone is a fine grained compact hard rock.

EXPOSURE 6.

Lying about 3 miles south of the outcrop just described another slight elevation above the prairie level occurs. Approaching this from the east a small clump of trees is observed in striking contrast with the treeless prairie around it. Numerous large boulders, principally gnessoid lie on this elevation. Good exposures of rock are shown at this place, where quarries have been opened from which stone has been quarried in considerable quantities for the manufacture of lime and building purposes.

About 5 feet of loose drift overlies the solid rock. This contains quite a number of large limestone boulders. The stone is very hard, in some cases almost flinty and in many respects the same as that of the upper layer at exposure 5. It shows little or no action on treatment with cold acid, but on heating slightly, effervesces readily. The rusty color in the stone is also observable here.

Fossils are comparatively scarce. There are many obscure remains which are, no doubt, corals, some allied to *Zaphrentis* and some to *Favosites*. In the stone of this place are found what appears to be the remains of plants, likely algæ. The stems are quite distinct, and are sometimes found in considerable quantities. These apparent stems vary from 3 lines to an inch in diameter.

They are found in a layer about 7 feet below the surface of rock. This stone in some parts shows a very distinct green coloring matter which, in several cases, coated the stemlike remains.

At first it was thought this might be caused by a fungus, although it seemed almost incredible that such could find its way to this layer so far below the surface. Examination does not seem to bear out this supposition. Another conclusion was that it might be a copper compound, but chemical tests have shown this to be a mistake. It may possibly be a silicate of iron. The coloring matter is quite thin and does not extend into the portions upon which it is found. It has been observed to coat several of the stem-like fossils, and also in some cases to form a more or less expanded appearance, but always in comparatively small patches. On one occasion a coral was found coated with the same. The quarrymen speak of having found a "green snake" petrified in the quarry, and maintain that there is no doubt but it was a snake. This likely has been one of these colored stems, and bears out my own experience that the coloring matter is frequently associated with these fossils.

The layers in the quarry are quite horizontal and show no signs of disturbance. The following is a vertical section of the last quarry opened:—

1. 4 feet loose material with limestone boulders.
2. $\frac{1}{2}$ foot showing glacial striæ.
- 3-4. $\frac{1}{4}$ and $\frac{1}{2}$ foot in thickness, and of yellowish color.
5. 2 feet thick. Fossils in the vicinity of this layer, especially below.
6. 3 feet, with stemlike impressions, most commonly casts.
- 7, 8, 9. 3, $1\frac{1}{4}$ and $1\frac{1}{4}$ feet, layers of hard rock.

Some of the thicker layers thin out towards the east. The surface layers are easily broken. Even the solid rock below is readily worked. There is no appearance of the reddish fossiliferous layer of Exposure 5 in this quarry. It likely underlies the rock at a greater depth than what has been exposed.

Fossils obtained from the reddish-grey deposit 40 feet below the surface at Stony Mountain :—

PLANTÆ.

1. Palæophycus.—Obscure markings of plant life.

CELEENTERATA

- 2, 3. *Clætetes delicatulus* (Nicholson) and *C. lycoperdon* (Hall.)—Especially the latter are represented here.
4. *Ptilodictya acuta* (Hall.)—A few specimens.
5. *Streptelasma corniculum* (Hall.)—Very common.
6. *Zaphrentis*.—A species comparatively common and characteristic. In outline resembles *Zaphrentis*, but possesses a marked tri-lobed appearance. On the curved side a transverse section is convex, but on the outside a distinct ridge is shown marked off by depressions along each side. This is no exceptional character, for the writer has obtained several specimens, usually about three inches in length, and all possessed the uniform tri-lobed condition.
7. *Favosites*.—In hemispherical masses, but the walls of the corallites so indistinct that no mural pores are discernible. Several fragments have been found which are likely of this species. Some small forms have been found which bear a marked resemblance to
8. *Favistella favosidea* of Hall. These usually occur in small, irregular masses.

ANNULOIDA.

9. Represented by Crinoid stems. These are smooth in contrast with those obtained at Selkirk.

ANNULOSA.

10. *Cheirurus icarus* (Billings.)—Glabella found.
11. *Calymene Blumenbachii* (Brogniart.)—Head found showing the eyes distinctly.

MOLLUSCA.

12. *Orthis testudinaria* (Dalman.)—Exceedingly common.
13. *Orthis subquadrata* (Hall.)—Common.
14. *Rhynchonella capax* (Conrad.)—Very numerous.
15. *Strophomena nitens* (Billings.)—Common.
16. *Strophomena Hecuba* (Billings.)—A well defined specimen.
17. *Strophomena*.—A smooth form but quite different from *nitens*. It is larger, more convex and not so well defined. Several have been found, all of uniform character.
18. *Murchisonia gracilis* (Hall.)—Several specimens. There are also a larger and coarser species of this genus common.
20. *Pleurotomaria*.—Members of this genus common.

- the surface at
21. *Ormoceras*.—The beaded siphuncle of a member of this genus.
22. *Cyrtoceras*.—The fragment of a curved cephalopod. Six segments are present. The diameter is five inches, and the general outline indicates a curved form of the shell, and no doubt belonging to the genus mentioned.

FOSSILS FROM THE UPPER BEDS OF STONY MOUNTAIN.

In nearly all cases these are very obscure, and cannot be identified beyond very general characters. Two species of coral are evidently present, one apparently allied to *Favosites*, the other to *Zaphrentis*. Besides these some fossils have been obtained which, no doubt, belong to the interesting genus—*Beatricia*—represented here by two species, of which several specimens have been found.

EXPOSURE 7.

This is found at Stonewall, 20 miles northwest of Winnipeg, and is considerably higher than the "mountain" of Exposure 5, though it does not rise abruptly above the surrounding district. Here a large quarry has been opened up which covers an area of four acres. Traces of glacial action are very marked upon the surface. *Striae* running in a N. NW. direction are seen for many yards, and so distinct that the most casual observer could not fail to be attracted by the uniform markings. The floors of several cellars in the village near by also afford examples of striated rock.

Here the *drift*, which is about seven feet deep, has been removed and foundations built upon the solid rock. The cellars under the buildings have floors of smooth, polished and striated rock, illustrating in a most striking manner glacial action.

The *striae* is in the same direction as at the quarry, N. NW. The stone from this place is entirely different from what has been described. It is hard and cherty, very white and effervesces but slightly on the addition of cold acid. When burnt it produces an exceedingly white lime, largely used by plasterers for finishing. Although apparently containing numerous fossils, they are restricted to but few spaces. The strata of this outcrop show no dip, present a very uniform condition wherever they were examined. No coloring matter is observed in the upper layers as in much of the rock at Exposures 5 and 6. This quarry, having been worked for considerable time, there is an excellent opportunity afforded for observing a vertical section, which may be represented as follows:—

Layers.	North Side.	South Side.
1.	1½ feet loose material.	1 foot loose material:
2.	1 foot rock.	1½ feet rock.
3.	1 " "	1½ " "
4.	2 " "	2 " "
5.	1¼ " "	3¼ " much broken & in thin layers
6.	1 " "	5 " light red color.
7.	3 " " contains numerous specimens of coral.	4 feet, quite red and hard, but when exposed to the weather breaks up. It contains no fossils.

On the south side the layers are much thicker than those on the north, and

more rock is thus exposed. At this part there is a large open well, on the sides of which the nature of the stone can be perceived. This enables the observer to see more rock than in other parts of the quarry.

Farther north on the ridge another exposure occurs. Here, layer 5 of the south side reaches the surface, and on one side of the ridge at this quarry where a well was dug, the first rock met after passing the drift, 28 feet deep, was the red layer 7, although the level of the surface was comparatively uniform. This seems to indicate denudation of the upper strata probably by a river or glacier passing between this place and exposure 5, (Stony Mountain) which would form an opposite bank for the mighty stream. Whatever fossils occur in this white limestone of Stonewall they are difficult to secure except in small pieces on account of the stone being so hard and sharp. The shells are very obscure, and though remains of primeval life are comparatively common, yet well defined specimens are rare. The following embrace the principal fossil types found by the writer in the clear white limestone of this place, more interesting for the evidence of glacial action it displays than fossils it contains :

1. *Palæophycus*.—Innumerable remains of plant-life are present. These are usually smooth and of uniform character, sometimes 2 or 3 feet in length, but never showing a branched form or surface markings of any kind.
2. *Favosites*.—Corals of this genus are very common. Mural pores and tabulæ are well marked. Although specimens are numerous still it is difficult to obtain anything more than a small fragment.
3. *Strophomena*.—Several imperfect specimens found.
4. *Murchisonia*.—One very interesting specimen of this genus was obtained.
5. *Pleurotomaria*.—This genus is represented by small forms.

Further investigation of this hard flint like stone will likely be rewarded with several forms, but there will always be more or less obscurity about them, in striking contrast with those obtained in the soft stone of Selkirk and the readily "weathered" of the lower layer at Stony Mountain.

This completes the description of 7 exposures of Silurian strata in the Red River Valley. These present four groups of rocks possessing marked differences in their lithological and palæontological characters, and may be represented in the following summary :—

SELKIRK ROCKS. EXPOSURES 1, 2, 3 AND 4.		STONEWALL. EXPOSURE 7.	
Condition.....	Comparatively soft.....	Condition.....	Hard and cherty.....
Action of cold acid.....	Effervesces readily.....	Action of cold acid.....	Slight effervescence.....
Color.....	Mottled light grey.....	Color.....	Very white.....
Fossils.....	Very numerous.....	Fossils.....	Several.....
Types.....	Corals and Cephalopods.....	Types.....	Corals.....

STONY MOUNTAIN.

EXPOSURES 5 AND 6.

	<i>Lower Beds.</i>	<i>Upper Beds.</i>
Condition.....	Soft.....	Very hard.....
Action Cold Acid.....	Strong effervescence.....	None, or very little.....
Color.....	Reddish grey.....	Clay, and yellowish.....
Fossils.....	Abundant.....	Few.....
Types.....	Brachiopods.....	Corals.....

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The relative position of these beds apparently seems to be in the following order, the lower mentioned first:—1, Selkirk ; 2, Reddish layer of Stony Mountain ; 3, Dolomitic layers of the same ; 4, Stonewall.

Regarding the geological horizon of each, it is difficult to arrive at a conclusion further than that the fossiliferous are decidedly Lower Silurian. The Selkirk rock has a most comprehensive group of fossils, there being representatives of several beds, but taking them as a whole the Trenton fossils are best represented. The rocks at Lower Fort Garry seem to indicate a transition bed between those of East Selkirk and the lower layer at Stony Mountain. They contain forms common to both. The fossils of the lower layers at Stony Mountain bear a marked resemblance to those found in the Hudson River group elsewhere, while the higher dolomitic beds and those of Stonewall probably border on the Niagara formation.

From these rocks upwards of 50 species have been obtained belonging principally to the Corals, Brachiopods and Cephalopods, together with some doubtful forms, such as Receptaculites, Beatricea and Stromatopora. The number and variety of fossils from these exposures indicate rich results to future investigators, and it is hoped will occupy the attention of members of the Historical and Scientific Society from time to time.